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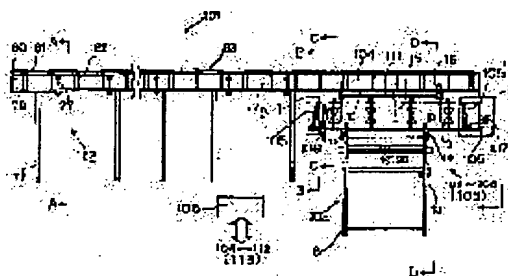
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(54) APPARATUS FOR CLASSIFYING LOG

(57)Abstract:

PROBLEM TO BE SOLVED: To classify logs by strength, by measuring weights, diametrical classes, impacts and natural frequencies of the logs on the basis of signals from a controller part of a strength-sorting apparatus and calculating strengths of logs on the basis of the measured values.

SOLUTION: A log is raised and stabilized by a weight measurement first-stage cylinder at a position where the log is loaded on a log transfer wheel 3. The log is raised and a weight of the log is measured by a second-stage cylinder at a log-supporting plate fixed to a receiver instrument via a load cell. A length of a cut end of the log in a vertical direction is measured by a vertical direction diameter measurement bar, and a length in a horizontal direction is measured by a horizontal direction diameter measurement bar. The lengths are averaged, thereby obtaining a diameter. A striking apparatus 106 drives a hammer by a strike cylinder to hit the cut end of the log. A natural frequency-measuring apparatus 107 measures a tertiary resonant frequency of the sound at this time. A Young's modulus is calculated from the diameter, weight read by a controller part 108, natural frequency and length. The log is sorted by color on the basis of a set strength class.



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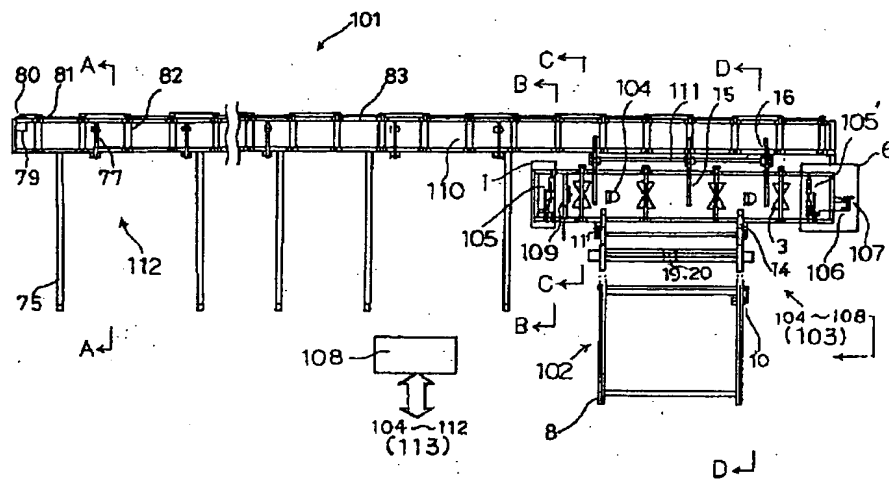
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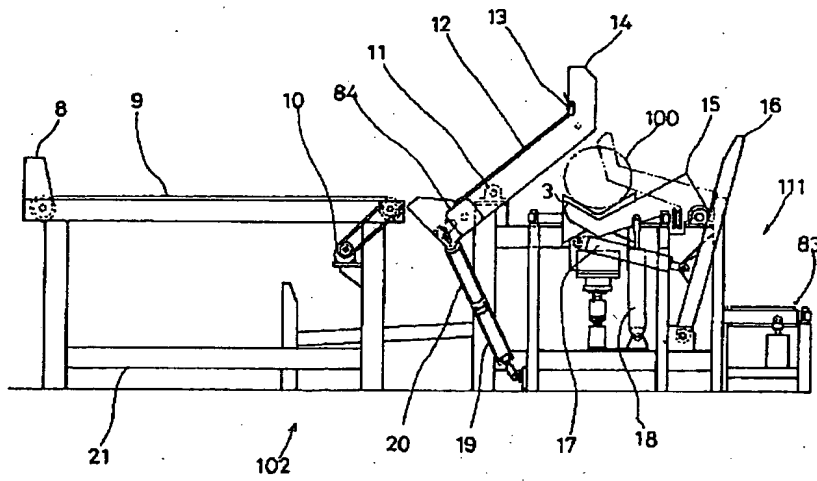
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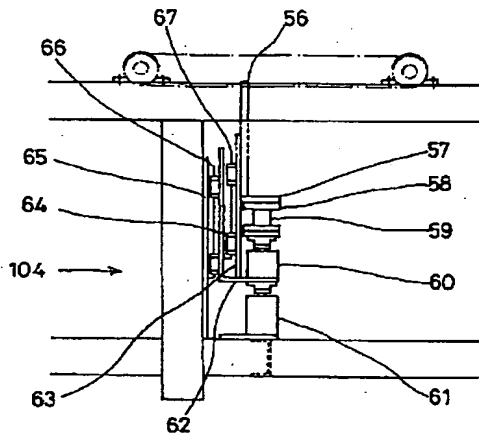
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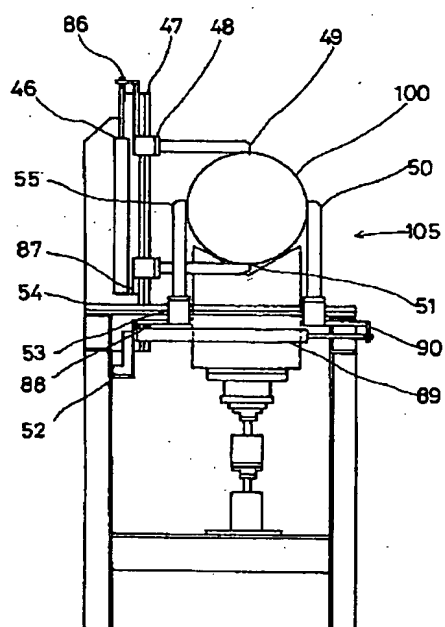
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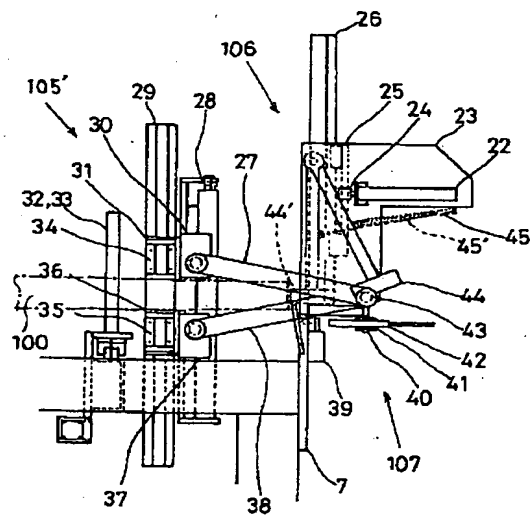
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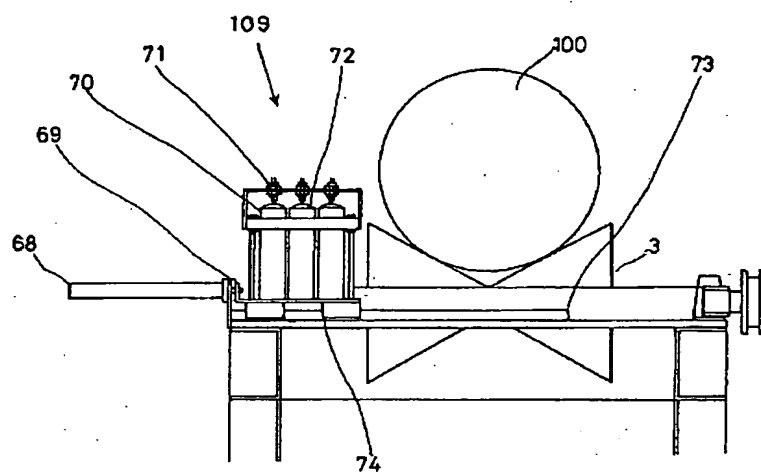
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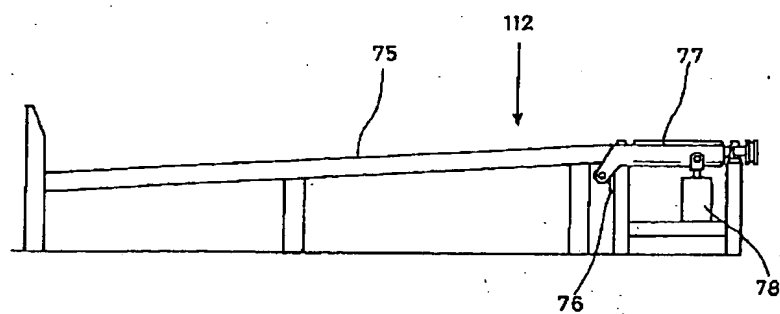
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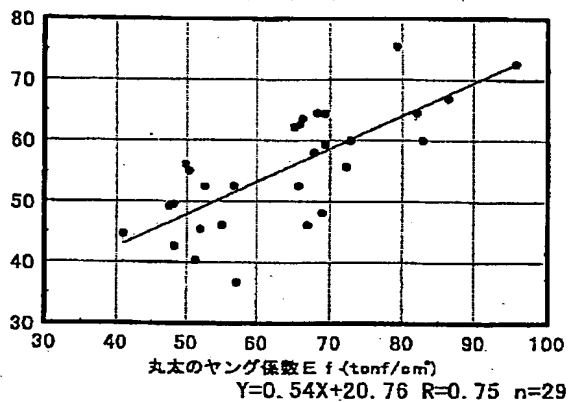
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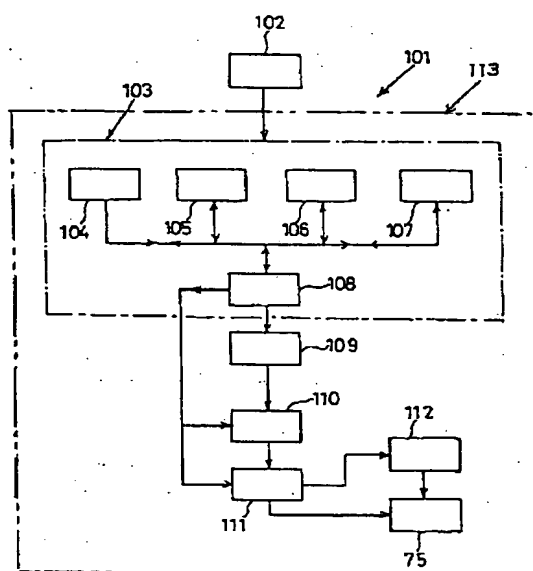
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drawing 9

製材品のヤング係数MOE (tonf/cm²)

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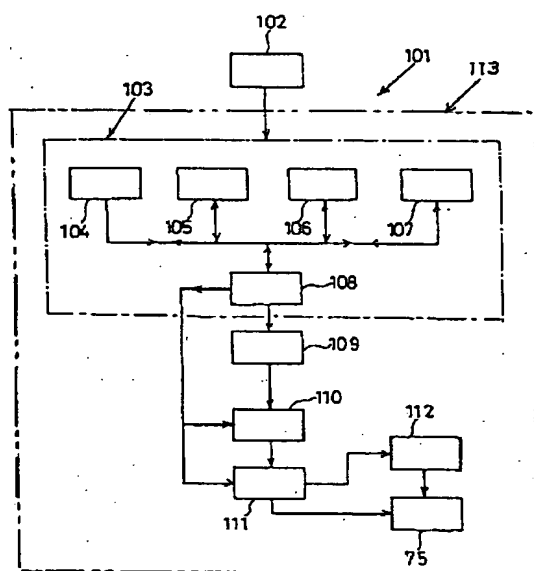
Drawing selection drawing 10



- | | |
|----------------|-----------------|
| 101: 等級区分装置 | 102: 供給装置 (搬入部) |
| 103: 強度計測部 | 104: 重量計測装置 |
| 105: 径計測装置 | 106: 打撃装置 |
| 107: 固有振動数測定装置 | 108: コントローラ部 |
| 109: 強度別色分け装置 | 110: 強度別仕分け搬出部 |
| 111: 取り出し装置 | 112: 径別強度仕分け |
| 113: 強度別仕分け装置 | 75: 区分材質フレーム |

[Translation done.]

Drawing selection drawing 10



- | | |
|----------------|-----------------|
| 101: 等級区分装置 | 102: 供給装置 (投入部) |
| 103: 強度計測部 | 104: 重量計測装置 |
| 105: 径級計測装置 | 106: 打撃装置 |
| 107: 固有振動数測定装置 | 108: コントローラ部 |
| 109: 強度別色分け装置 | 110: 強度別仕分け搬出部 |
| 111: 取り出し装置 | 112: 径級別強度仕分け |
| 113: 径度別仕分け装置 | 75: 区分材質フレーム |

[Translation done.]

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1. This document has been translated by computer. So the translation may not reflect the original precisely.
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CLAIMS

[Claim(s)]

[Claim 1] Grading equipment 101 of the log equipped with the feeder 102 of a log, and the assortment equipment 113 according to intensity characterized by providing the following. The assortment equipment 113 according to intensity is the weight metering device 104 of a log. Path class metering-device 105, 105'. The blow equipment 106 and the resonant frequency measuring device 107 of a log. The controller section 108 which performs on-the-strength calculation based on the measurement value of each aforementioned equipment.

[Claim 2] Grading equipment of the log according to claim 1 with which the assortment equipment 113 according to intensity of a log is equipped with the classification-by-color equipment 109 classified by intensity which classifies a log by color according to intensity, and carries out the feature of the bird clapper.

[Claim 3] Grading equipment of the log according to claim 1 or 2 characterized by being that to which the weight metering device 104 of a log measures a weight by the load cell 59 through carrying-in frame drive [the 1st step of] cylinder 19 which it comes to prepare in two stages, and carrying-in frame drive [the 2nd step of] cylinder 20.

[Claim 4] Grading equipment of a log given in any 1 term of the claims 1-3 to which the blow equipment 106 of a log draws the hammer 44 of the blow section near by the coil spring 45 from the back of the blow direction, forms the blow head 24 at the nose of cam of the cylinder 22 for a blow, and is characterized by the bird clapper.

[Claim 5] Grading equipment of a log given in one 1st term of the claims 1-4 characterized by being what path class metering-device 105, 105' of a log measures a total of four places from the upper and lower sides and right and left, and calculates an average diameter as with the bars 49 and 51 for the perpendicular direction diameter measurement and the bars 50 and 55 for horizontal diameter measurement which supported the diameter of the ends cross-section-of-wood section in the cylinders 46 and 89 for diameter measurement.

[Claim 6] Grading equipment of a log given in any 1 term of the claims 1-5 to which the blow equipment 106 of a log establishes the automatic positioning mechanism in which the position of the hammer 44 of the blow section and the position of the microphone 42 for vibration pickups by blow operate so that it may come to the center of a log, according to the size of a log, and is characterized by the bird clapper.

[Claim 7] Grading equipment of a log given in any 1 term of the claims 1-6 to which it uses shock absorbing material 41, and is characterized by the bird clapper in case the blow equipment 106 of a log holds a microphone.

[Claim 8] Grading equipment of a log given in any 1 term of the claims 1-7 which the controller section 108 of the grading equipment 101 of a log reads the resonant frequency when hitting a log, and are characterized by being what performs on-the-strength calculation of a log by making 3rd resonance frequency into a measurement value.

[Claim 9] Grading equipment of a log given in any 1 term of the claims 1-8 characterized by classifying simultaneously an on-the-strength grade and a path class grade in the grading equipment of a log.

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DETAILED DESCRIPTION

[Detailed Description of the Invention]

[0001]

[The technical field to which invention belongs] this invention relates to the feeder of a log, and the grading equipment of the log equipped with the assortment equipment according to intensity.

[0002]

[Description of the Prior Art] As equipment which classifies the on-the-strength grade of a log, it grows, and it is a state, the cross section of wood of a log is hit [it stacks, and] with a hammer etc., the resonant frequency of the log at that time is measured, and the simple method of presuming the Young's modulus of a log in a bolt commercial scene etc. is proposed (JP, 7-103945, A official report). Moreover, although the partition of the path class of a log is generally performed by measuring the diameter of a log in a bolt commercial scene etc., the example which is performing mechanically the on-the-strength partition (classification according to intensity) of a log until now is not seen.

[0003]

[Problem(s) to be Solved by the Invention] In the partition technology of the on-the-strength grade of the conventional log, since it grows, and it stacks, the density of a log is presumed per group of a state and a Young's modulus is computed using the value, only the near intensity of a log is known. For this reason, although it grows, and it stacks and comparison of the intensity of the group unit comrade of a state or the log comrade in the inside of the group unit can be performed, evaluating the computed value as an on-the-strength value of each log runs short of reliability. Moreover, efficiency was inferior, in order to obtain and stack, to measure in the state and to have classified the log for every class, such as intensity, if a great effort is required and united with carrying out total measurement by the conventional method, since it depends for measurement on the help.

[0004]

[Means for Solving the Problem] this invention person made it possible to establish the supply organization of the log according to the use, and to attain the increase in efficiency of manufacture of wooden goods in view of the above, by carrying out total measurement of each weight, path class, and resonant frequency mechanically, offering the equipment in which the class partition which is reliability, such as being high, is possible, and using this equipment further, about the log accumulated on the bolt commercial scene etc. as a result of wholeheartedly research. That is, this invention is grading equipment of the log of the following composition.

(1) In the grading equipment 101 of the log equipped with the feeder 102 of a log, and the assortment equipment 113 according to intensity The assortment equipment 113 according to intensity The weight metering device 104 and path class metering-device 105, 105' of a log, It comes to have the on-the-strength measurement section 103 of the log which consists of the blow equipment 106 of a log and a resonant frequency measuring device 107, and the controller section 108 that performs on-the-strength calculation based on the measurement value of each aforementioned equipment. Grading equipment of the log characterized by being what classifies a log according to intensity based on the signal from the aforementioned controller section 108.

(2) Grading equipment of a log given in (1) term to which the assortment equipment 113 according to intensity of a log equips with the classification-by-color equipment 109 classified by

intensity which classifies a log by color according to intensity, and carries out the feature of the bird clapper.

(3) a log -- a weight -- a metering device -- 104 -- a cylinder -- two -- stages -- preparing -- becoming -- carrying in -- a frame -- a drive -- one -- a step -- ** -- a cylinder -- 19 -- carrying in -- a frame -- a drive -- two -- a step -- ** -- a cylinder -- 20 -- minding -- a load cell -- 59 -- a weight -- measuring -- a thing -- it is -- things -- the feature -- ** -- carrying out -- (-- one --) -- a term -- or

(4) Grading equipment of a log given in any 1 term of the (1) term - (3) term to which the blow equipment 106 which is a log draws the hammer 44 of the blow section near by the coil spring 45 from the back of the blow direction, forms the blow head 24 at the nose of cam of the cylinder 22 for a blow, and is characterized by the bird clapper.

[0005] (5) Grading equipment of a log given in any 1 term of the (1) term - (4) term characterized by being what the path class metering device 105 which is a log measures a total of four places from the upper and lower sides and right and left, and calculates an average diameter as with the bars 49 and 51 for the perpendicular direction diameter measurement and the bars 50 and 55 for horizontal diameter measurement which supported the diameter of the ends cross-section-of-wood section in the cylinders 46 and 89 for diameter measurement.

(6) a log -- a blow -- equipment -- 106 -- a log -- a size -- responding -- a blow -- the section -- a hammer -- 44 -- a position -- and -- a blow -- depending -- a vibration pickup -- ** -- a microphone -- 42 -- a position -- a log -- a center -- coming -- as -- operating -- automatic -- positioning -- a mechanism -- preparing -- a bird clapper -- the feature -- ** -- carrying out -- (-- one --) -- a term -- -- -- (-- five --)

(7) Grading equipment of a log given in any 1 term of the (1) term - (6) term to which it uses shock absorbing material 41, and is characterized by the bird clapper in case the blow equipment 106 of a log holds a microphone.

(8) a log -- grading -- equipment -- 101 -- a controller -- the section -- 108 -- a log -- having hit -- the time -- a resonant frequency -- reading -- the -- three -- order -- resonance frequency -- a measurement value -- ** -- carrying out -- a log -- intensity -- calculation -- carrying out -- a thing -- it is -- things -- the feature -- ** -- carrying out -- (-- one --) -- a term -- -- -- (-- seven --) -- a term -- some -- one -- a term -- a

(9) Grading equipment of a log given in any 1 term of the (1) term - (8) term characterized by classifying simultaneously an on-the-strength grade and a path class grade in the grading equipment of a log.

[0006]

[Embodiments of the Invention] The gestalt of implementation of invention is explained with reference to a drawing based on an example. Drawing 1 is the plan showing the whole grading equipment of the log of this invention, and the schematic diagram of the controller section. In drawing 1 the wheel for ** material, and 6 for diameter measurement section covering and 3 Measurement section covering, In 8, injection equipment and 10 the carrying-in equipment axis of rotation and 14 for the motor for ** material, and 11 A carrying-in frame, 15 a log eccentric lever and 19 for a log taking-out lever and 16 Carrying-in frame drive [the 1st step of] cylinder, Carrying-in frame drive [the 2nd step of] cylinder and 75 20 A partition material ** frame, 79 a sprocket and 81 for a partition material ** material motor and 80 The chain for ** material, 82 a partition material ** material frame and 101 for the koro for ** material, and 83 Grading equipment, 102 a weight metering device and 105, 105' for a feeder (carrying-in section) and 104 A path class metering device, In 106, the controller section and 109 take out a resonant frequency measuring device and 108, blow equipment and 107 take out the classification taking-out section classified by intensity, and 111 for the classification-by-color equipment classified by intensity, and 110, equipment and 112 show the on-the-strength classification classified by path class, and 113 shows the assortment equipment according to intensity. Hereafter, the structure and operation are explained based on each drawing of drawing 2 - drawing 10. Drawing 2 is the front view of the D-D cross section of drawing 1, and is mechanism explanatory drawing of an injection of a log, carrying in, and a taking-out portion. drawing -- setting -- 9 -- the chain for ** material, and

12 -- the chain for carrying in, and 13 -- a ***** switch and 17 -- in an eccentric cylinder and 18, a partition material ** material frame and 84 take out an injection frame and 83, a taking-out cylinder and 21 take out a log and 111 for a ** material motor and 100, and equipment and 102 show a feeder (carrying-in section)

[0007] In drawing 2, with the injection equipment 8 of a log, the log is beforehand loaded on the chain 9 for ** material of the injection frame 21, and an injection switch (not shown) is operated, the motor 10 for ** material is driven, and it puts one at a time on the carrying-in frame 14. If put on the aforementioned carrying-in frame 14, carrying-in frame drive [the 1st step of] cylinder 19 will rotate the carrying-in frame 14 to the position which becomes level to the surroundings of the carrying-in equipment axis of rotation 11, and will stop. And if the chain 12 for carrying in is driven by the ** material motor 84, it sends to the nose of cam of the carrying-in frame 14 and the ***** switch 13 turns on, while stopping the ** material motor 84, the carrying-in frame 14 is rotated in carrying-in frame drive [the 2nd step of] cylinder 20, and a log is carried on the wheel 3 (drawing 1 , drawing 3) for ** material.

[0008] Drawing 3 is the front view of the main part of grading equipment of the log of this invention, and is outline explanatory drawing. In drawing, in a coloring positioning stopper and 5, the limit switch for a coloring material check and 7 show a blow positioning stopper, and 85 shows [2 / the positioning stopper of diameter measurement, and 4] a ** material motor. In addition, the classification-by-color equipment 109 (drawing 1 , drawing 7 postscript) classified by intensity was omitted.

[0009] Next, the structure of the weight metering device 104 shown in drawing 3 and an operation are explained. Drawing 4 is the side elevation of the weight metering device 104. drawing -- setting -- 56 -- a log support plate and 57 -- a log support plate receptacle and 58 -- a load cell receptacle implement, 59 load cells, and 60 -- in the 2nd step cylinder for weight measurement, and 61, the 2nd step dummy support, and 64 and 65 show 66, and, as for the 1st step cylinder for weight measurement, and 62, guide block and 67 show a guide rail, as for the 1st step dummy support and 63 In drawing 4, after lifting a log in the 1st step cylinder 61 for weight measurement and stabilizing a log in the position put on the wheel 3 (drawing 1 , drawing 3) for ** material by the aforementioned carrying-in frame 14 (drawing 1 , drawing 2), with the log support plate 56 fixed to the load cell receptacle implement 58 through the load cell 59 in the 2nd step cylinder 60 for weight measurement, a log is lifted and a weight is measured with a metering device. As for a weight metering device, it is desirable to use the guide block 64 and 65 with which the ball bearing was enclosed so that the disturbance by frictional resistance etc. might not influence the display of a load cell, and guide rails 66 and 67. The above-mentioned weight measurement value is sent to the controller section 108 (drawing 1 , drawing 10), and serves as data of on-the-strength calculation. After the completion of weight measurement releases previously the 2nd step cylinder 60 for weight measurement, next releases the 1st step cylinder 61 for weight measurement, and it is made to protect a load cell 59. If the weight measurement backward above-mentioned load cell 59 is released, with the wheel 3 for ** material shown in drawing 3, by the ** material motor 85, it will carry out ** material and will stop till the place of the positioning stopper 2 of diameter measurement.

[0010] Next, the structure of a path class metering device and an operation are explained. Drawing 5 is the B-B cross section of drawing 1, and is the front view of a diameter metering device. drawing -- setting -- 46 -- the cylinder for diameter measurement, and 47 -- a guide rail and 48 -- guide block, and 49 and 51 -- the bar for the perpendicular direction diameter measurement, and 50 and 55 -- in guide block and 54, a guide rail, and 87, 88 and 90 show a bar, and 89 shows [the bar for horizontal diameter measurement, and 52 / a cylinder soffit positioning stopper and 53] the cylinder for diameter measurement As shown in drawing 5, the length of the perpendicular direction of the cross section of wood of a log 100 is measured with the bars 49 and 51 for the perpendicular direction diameter measurement, and horizontal length is measured with the bars 50 and 55 for horizontal diameter measurement again, and both average is taken and it considers as the diameter of a log which is a cross section of wood on the other hand. It is fixed to guide block 48, and the bar 49 for the perpendicular direction diameter measurement enables it to

slide on a guide-rail 47 top, and connects the guide block 48 with the end of the cylinder 46 for diameter measurement through a bar 86. The bar 51 for the perpendicular direction diameter measurement is connected also like the other end. The bars 50 and 55 for horizontal diameter measurement are also made into the same structure, and are connected with the cylinder 89 for diameter measurement. Since guide block which slides on a guide-rail top freely was connected so that it might consider as the end and the other end of a cylinder, it becomes unnecessary thus, to fix the position of a log 100 correctly at the time of measurement. That is, it is because it is hung by it and the whole cylinder can move, if a log is inserted with the aforementioned bar for diameter measurement.

[0011] Next, a log 100 is sent to the blow positioning stopper 7 through the wheel 3 for ** material (drawing 3), the diameter of the remaining cross section of wood of a log 100 is measured by the bars 32 and 33 for diameter measurement, and 34 and 35 like the above (drawing 6), and an average diameter is computed. The vertical and each level diameter measurement value of the above-mentioned cross section of wood are sent to the controller section (drawing 1 , drawing 10), and serve as data of on-the-strength calculation and a path class partition.

[0012] Next, the structure of the blow equipment of a log and an operation are explained. Drawing 6 is diameter measurement of a log, and explanatory drawing of blow equipment. In drawing a blow positioning stopper and 22 7 The cylinder for a blow, 23 a blow head and 25 for a blow equipment frame and 24 Guide block, In 26, a guide rail and 27 links 1 and 28 The cylinder for blow equipment movement, 29 the bearing for a link, and 31 for the guide rail for diameter measurement, and 30 Guide block, 32-35 guide block and 37 for the bar for diameter measurement, and 36 The bearing for a link, 38 the switch for *****, and 40 for links 2 and 39 Microphone maintenance metallic ornaments, 41 -- shock absorbing material and 42 -- the microphone for vibration pickups, and 43 -- a link pin and 44 -- in a hammer and 44', the coil-spring position at the time of a blow and 106 show blow equipment, and, as for the hammer position at the time of a blow, and 45, 107 shows a resonant frequency measuring device, as for a coil spring and 45'

[0013] As shown in drawing 6 , blow equipment 106 is set in the state after the 2nd diameter measurement of a cross section of wood. As a hammer 44 is driven in the cylinder 22 for a blow after releasing the aforementioned bars 32 and 33 for diameter measurement, and 34 and 35, the cross section of wood of a log 100 is hit and it is shown in the resonant frequency measuring device 107 The resonance frequency of the sound at this time is collected with the microphone 42 for vibration pickups. in the controller section 108 (drawing 1 , drawing 10) The frequency of the peak value of the wave is defined as the primary resonance frequency [secondary / 3rd] from the method of a low of frequency, and the 3rd resonance frequency (3rd resonance frequency) is adopted. Moreover, the aforementioned microphone 42 for vibration pickups is held with shock absorbing material 41, such as sponge, and is being fixed to the blow equipment frame 23. The cylinder 22 for a blow and the hammer 44 are attached in this blow equipment frame 23, and these whole is connected with it possible [sliding] by the link pin 43. Moreover, when the bars 34 and 35 for diameter measurement which slide on the guide-rail 29 top for diameter measurement through a link 1 (27) and a link 2 (38) opened and closed, this link pin 43 is interlocked with it, and the link pin 43 goes up and down it, and it enabled it to maintain the position of a hammer 44 at the center of a log 100. And the blow head 24 was formed at the nose of cam of the aforementioned cylinder 22 for a blow, the coil spring 45 was attached in the middle of the arm of a hammer 44, and the hammer 44 is drawn near from the opposite side of the blow direction. A position and strength are adjusted so that a coil spring 45 may not hit a log 100 further after a hammer's 44 hitting.

[0014] When abnormalities are in the judgment result of the above-mentioned measurement, and a measurement value, again, it hits and measurement is redone. When abnormalities are in a measurement result 5 times or more, measurement is stopped and a log and a system are checked.

[0015] Next, based on the "formula 1" shown in the following, the Young's modulus of a log is computed in the controller section 108 from the length of the log 100 beforehand inputted as the

diameter of the log 100 read in the controller section 108 (drawing 1 , drawing 10), the weight, and the resonant frequency (3rd resonance frequency). Then, a log 100 is sent to the coloring positioning stopper 4 with the wheel 3 (drawing 3) for ** material, and it is colored the cross section of wood of a log 100 according to intensity based on the on-the-strength grade which had carried out an arbitrary setup beforehand (postscript).

the above, and "formula 1": $Ef=4L^2f^2\rho/980$ -- here, they are the Young's modulus (Kgf/cm²) of Ef:log, and the density [of L:log] of a length (cm) f:log of a resonant frequency (Hz) rho:log (kg/cm³)

[0016] Next, the coloring according to intensity to a log is explained. Drawing 7 is classification-by-color plant layout drawing classified by intensity with the C-C cross section of drawing 1 . drawing -- setting -- 68 -- a coloring equipment drive cylinder and 69 -- a coloring equipment susceptor and 70 -- in spray fixed metallic ornaments and 73, a guide rail and 74 show guide block and 109 shows [a spray and 71 / the cylinder for coloring, and 72] the classification-by-color equipment classified by intensity ** [lighting of the coloring according to intensity to a log of the limit switch 5 (drawing 3) for a coloring material check / move / horizontally / to the center of a log 100 / the coloring equipment drive cylinder 68 / the coloring equipment susceptor 69 fixed through the guide block 74 which slides on the guide-rail 73 top of drawing 7] And the cylinder 71 for coloring is driven according to the directions from the controller section 108 (drawing 1 , drawing 10), a spray 70 is pushed, and a log 100 is colored. For example, in a two or more Young's-modulus 70x10³ Kgf/cm log, 50x10³ Kgf/cm² <= log <70x10³ Kgf/cm² colors red blue and a less than two 50x10³ Kgf/cm log black.

[0017] And finally a log 100 is sent to the coloring positioning stopper 4 with the wheel 3 (drawing 3) for ** material, and a log 100 is taken out out of a measuring instrument with the log taking-out lever 15 (drawing 2). The above-mentioned log taking-out lever 15 is driven in the taking-out cylinder 18, and receives a log 100 with the log discharge lever 16. This log discharge lever 16 that received the log 100 is driven in the discharge cylinder 17, and takes down a log 100 to the partition material ** material frame 83.

[0018] Next, the classification after eccrisis is explained. Drawing 8 is drawing of the partition material eccrisis section and a partition material place with the A-A cross section of drawing 1 . In drawing, in a partition material ** frame and 76, a partition material eccrisis bearing and 77 show a partition material eccrisis lever (drawing 1), and 78 shows [75] a partition material eccrisis cylinder. After eccrisis, it takes out with the classification taking-out section 110 (drawing 10) classified by intensity of a log, equipment 111 (drawing 10) is controlled by the controller section 108 (drawing 1 , drawing 10), and it takes on-the-strength classification 112 (drawing 1 , drawing 10) according to the path class. The log 100 taken down on the partition material ** material frame 83 with the aforementioned log eccrisis lever 16 (drawing 2) aligns on the partition material ** frame 75 (drawing 1 , drawing 8) with the partition material eccrisis lever 77 (drawing 1 , drawing 8) according to the intensity classified by each grade by the koro 82 for ** material driven by the partition material ** material motor 79 (drawing 1).

[0019] Next, correlation of the actual bending Young's modulus of a timber trimming **** lumber article is indicated from it to be the Young's modulus of the log measured using this equipment. Drawing 9 is the correlation diagram of Young's modulus Ef of a log, and Young's modulus MOE of a lumber article. In drawing, they are R= correlation coefficient and n= measurement size. As shown in drawing, both correlation is understood that it is as high as 0.75 and the reliability of on-the-strength evaluation of this equipment is high.

[0020] The block diagram of the whole grading equipment of the log of this invention is shown in drawing 10 . In drawing, the controller section 108 is a computer, orders it on-the-strength calculation and control of equipment with the measurement data from the sensor of each aforementioned equipment, and carries out the on-the-strength partition of a log by classification by color with the classification-by-color equipment 109 classified by intensity. And after controlling the classification taking-out section 110 classified by intensity, and ejection equipment 111 after discharge and taking on-the-strength classification 112 classified by path class, a log 100 aligns on the partition material ** frame 75 according to the on-the-strength classification

classified by path class according to the intensity classified according to the grade.

[0021]

[Effect of the Invention] It gets twisted in this invention and the operation effect like ***** is demonstrated.

In order according to invention of 1 and a claim 1 for the on-the-strength measurement section of a log to be constituted by a weight metering device, a path class metering device, and blow equipment and its natural-vibration measuring device, to calculate such measurement data synthetically in the controller section and to perform on-the-strength evaluation, correlation with the intensity of an actual lumber article is high, and it is reliable.

According to invention of 2 and a claim 2, since a coloring partition can be carried out with classification-by-color equipment according to the intensity of a log, the classification display according to intensity is clear, and intelligible.

Although a log rotates in the stabilized direction and a shocking load is applied to a weight metering device when almost all the logs with which measurement is presented are put on the susceptor of a weight metering device according to invention of 3 and a claim 3, since deflection and its cross section were irregular circles It writes as the structure of making the cylinder of a log into two stages with this equipment, lifting a log in the cylinder of the 1st step, supporting a log in the stable position and next lifting it further in the cylinder of the 2nd step through a load cell. It can avoid that a shocking load joins a load cell, and it is possible. [of an exact gravimetry]

Since hitting a log further after a hammer's hitting since according to invention of 4 and a claim 4 the hammer of the blow section of a log is drawn near with a spring from the back of the blow direction and a position and strength are adjusted was prevented and it attached the blow head at the nose of cam of a cylinder rod again, generating of unnecessary blow sound is pressed down.

In case according to invention of 5 and a claim 5 a measurement bar is applied and measured in both the cross-sections-of-wood section of a log from the 2-way which intersects perpendicularly, those averages are written as a diameter value and it asks for the timber volume of a log, the error by deformation of a cross section etc. can be lessened.

Since according to invention of 6 and a claim 6 the automatic positioning mechanism was established so that blow equipment might come the position of the microphone for vibration pickups by blow, and a hammer to the center of the cross section of wood according to the size of a log, the measurement data of the resonant frequency of an exact log can be obtained.

According to invention of 7 and a claim 7, it can prevent that a noise mixes in blow sound by vibration of a base material by having supported the microphone for blow sound sound-collecting through shock absorbing material.

According to invention of 8 and a claim 8, the resonant frequency when hitting a log is read, the 3rd resonance frequency is written as a measurement value, and the functionality of the Young's modulus of a log and the Young's modulus of them to a timber trimming **** lumber article is high.

According to invention of 9 and a claim 9, since the grade according to intensity and the grade according to path class are [grading of a log] simultaneously classifiable, the supply organization of the log according to the use can be established, and the increase in efficiency of manufacture of a wood product can be attained.

[Translation done.]

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TECHNICAL FIELD

[The technical field to which invention belongs] this invention relates to the feeder of a log, and the grading equipment of the log equipped with the assortment equipment according to intensity.

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PRIOR ART

[Description of the Prior Art] As equipment which classifies the on-the-strength grade of a log, it grows, and it is a state, the cross section of wood of a log is hit [it stacks, and] with a hammer etc., the resonant frequency of the log at that time is measured, and the simple method of presuming the Young's modulus of a log in a bolt commercial scene etc. is proposed (JP, 7-103945, A official report). Moreover, although the partition of the path class of a log is generally performed by measuring the diameter of a log in a bolt commercial scene etc., the example which is performing mechanically the on-the-strength partition (classification according to intensity) of a log until now is not seen.

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EFFECT OF THE INVENTION

[Effect of the Invention] It gets twisted in this invention and the operation effect like ***** is demonstrated.

In order according to invention of 1 and a claim 1 for the on-the-strength measurement section of a log to be constituted by a weight metering device, a path class metering device, and blow equipment and its natural-vibration measuring device, to calculate such measurement data synthetically in the controller section and to perform on-the-strength evaluation, correlation with the intensity of an actual lumber article is high, and it is reliable.

According to invention of 2 and a claim 2, since a coloring partition can be carried out with classification-by-color equipment according to the intensity of a log, the classification display according to intensity is clear, and intelligible.

In invention of 3 and a claim 3, deflection and its cross section of almost all the logs with which measurement is presented are irregular circles. Therefore, although a log rotates in the stabilized direction and a shocking load is applied to a weight metering device when it puts on the susceptor of a weight metering device It writes as the structure of making the cylinder of a log into two stages with this equipment, lifting a log in the cylinder of the 1st step, supporting a log in the stable position and next lifting it further in the cylinder of the 2nd step through a load cell. It can avoid that a shocking load joins a load cell, and it is possible. [of an exact gravimetry]

Since hitting a log further after a hammer's hitting since according to invention of 4 and a claim 4 the hammer of the blow section of a log is drawn near with a spring from the back of the blow direction and a position and strength are adjusted was prevented and it attached the blow head at the nose of cam of a cylinder rod again, generating of unnecessary blow sound is pressed down.

In case according to invention of 5 and a claim 5 a measurement bar is applied and measured in both the cross-sections-of-wood section of a log from the 2-way which intersects perpendicularly, those averages are written as a diameter value and it asks for the timber volume of a log, the error by deformation of a cross section etc. can be lessened.

Since according to invention of 6 and a claim 6 the automatic positioning mechanism was established so that blow equipment might come the position of the microphone for vibration pickups by blow, and a hammer to the center of the cross section of wood according to the size of a log, the measurement data of the resonant frequency of an exact log can be obtained.

According to invention of 7 and a claim 7, it can prevent that a noise mixes in blow sound by vibration of a base material by having supported the microphone for blow sound sound-collecting through shock absorbing material.

According to invention of 8 and a claim 8, the resonant frequency when hitting a log is read, the 3rd resonance frequency is written as a measurement value, and the functionality of the Young's modulus of a log and the Young's modulus of them to a timber trimming **** lumber article is high.

According to invention of 9 and a claim 9, since the grade according to intensity and the grade according to path class are [grading of a log] simultaneously classifiable, the supply organization of the log according to the use can be established, and the increase in efficiency of manufacture of a wood product can be attained.

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TECHNICAL PROBLEM

[Problem(s) to be Solved by the Invention] In the partition technology of the on-the-strength grade of the conventional log, since it grows, and it stacks, the density of a log is presumed per group of a state and a Young's modulus is computed using the value, only the near intensity of a log is known. For this reason, although it grows, and it stacks and comparison of the intensity of the group unit comrade of a state or the log comrade in the inside of the group unit can be performed, evaluating the computed value as an on-the-strength value of each log runs short of reliability. Moreover, efficiency was inferior, in order to obtain and stack, to measure in the state and to have classified the log for every class, such as intensity, if a great effort is required and united with carrying out total measurement by the conventional method, since it depends for measurement on the help.

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MEANS

[Means for Solving the Problem] this invention person made it possible to establish the supply organization of the log according to the use, and to attain the increase in efficiency of manufacture of wooden goods in view of the above, by carrying out total measurement of each weight, path class, and resonant frequency mechanically, offering the equipment in which the class partition which is reliability, such as being high, is possible, and using this equipment further, about the log accumulated on the bolt commercial scene etc. as a result of wholeheartedly research. That is, this invention is grading equipment of the log of the following composition.

(1) In the grading equipment 101 of the log equipped with the feeder 102 of a log, and the assortment equipment 113 according to intensity The assortment equipment 113 according to intensity The weight metering device 104 and path class metering-device 105, 105' of a log, It comes to have the on-the-strength measurement section 103 of the log which consists of the blow equipment 106 of a log and a resonant frequency measuring device 107, and the controller section 108 that performs on-the-strength calculation based on the measurement value of each aforementioned equipment. Grading equipment of the log characterized by being what classifies a log according to intensity based on the signal from the aforementioned controller section 108.

(2) Grading equipment of a log given in (1) term to which the assortment equipment 113 according to intensity of a log equips with the classification-by-color equipment 109 classified by intensity which classifies a log by color according to intensity, and carries out the feature of the bird clapper.

(3) a log -- a weight -- a metering device -- 104 -- a cylinder -- two -- stages -- preparing -- becoming -- carrying in -- a frame -- a drive -- one -- a step -- ** -- a cylinder -- 19 -- carrying in -- a frame -- a drive -- two -- a step -- ** -- a cylinder -- 20 -- minding -- a load cell -- 59 -- a weight -- measuring -- a thing -- it is -- things -- the feature -- ** -- carrying out -- (-- one --) -- a term -- or

(4) Grading equipment of a log given in any 1 term of the (1) term - (3) term to which the blow equipment 106 which is a log draws the hammer 44 of the blow section near by the coil spring 45 from the back of the blow direction, forms the blow head 24 at the nose of cam of the cylinder 22 for a blow, and is characterized by the bird clapper.

[0005] (5) Grading equipment of a log given in any 1 term of the (1) term - (4) term characterized by being what the path class metering device 105 which is a log measures a total of four places from the upper and lower sides and right and left, and calculates an average diameter as with the bars 49 and 51 for the perpendicular direction diameter measurement and the bars 50 and 55 for horizontal diameter measurement which supported the diameter of the ends cross-section-of-wood section in the cylinders 46 and 89 for diameter measurement.

(6) a log -- a blow -- equipment -- 106 -- a log -- a size -- responding -- a blow -- the section -- a hammer -- 44 -- a position -- and -- a blow -- depending -- a vibration pickup -- ** -- a microphone -- 42 -- a position -- a log -- a center -- coming -- as -- operating -- automatic -- positioning -- a mechanism -- preparing -- a bird clapper -- the feature -- ** -- carrying out -- (-- one --) -- a term -- -- -- (-- five --)

(7) Grading equipment of a log given in any 1 term of the (1) term - (6) term to which it uses shock absorbing material 41, and is characterized by the bird clapper in case the blow equipment 106 of a log holds a microphone.

(8) a log -- grading -- equipment -- 101 -- a controller -- the section -- 108 -- a log -- having hit -- the time -- a resonant frequency -- reading -- the -- three -- order -- resonance frequency -- a measurement value -- ** -- carrying out -- a log -- intensity -- calculation -- carrying out -- a thing -- it is -- things -- the feature -- ** -- carrying out -- (-- one --) -- a term -- -- -- (-- seven --) -- a term -- some -- one -- a term -- a

(9) Grading equipment of a log given in any 1 term of the (1) term - (8) term characterized by classifying simultaneously an on-the-strength grade and a path class grade in the grading equipment of a log.

[0006]

[Embodiments of the Invention] The form of implementation of invention is explained with reference to a drawing based on an example. Drawing 1 is the plan showing the whole grading equipment of the log of this invention, and the schematic diagram of the controller section. In drawing 1 the wheel for ** material, and 6 for diameter measurement section covering and 3 Measurement section covering, In 8, injection equipment and 10 the carrying-in equipment axis of rotation and 14 for the motor for ** material, and 11 A carrying-in frame, 15 a log discharge lever and 19 for a log taking-out lever and 16 Carrying-in frame drive [the 1st step of] cylinder, Carrying-in frame drive [the 2nd step of] cylinder and 75 20 A partition material ** frame, 79 a sprocket and 81 for a partition material ** material motor and 80 The chain for ** material, 82 a partition material ** material frame and 101 for KORO for ** material, and 83 Grading equipment, 102 a weight metering device and 105,105' for a feeder (carrying-in section) and 104 A path class metering device, In 106, the controller section and 109 take out a resonant frequency measuring device and 108, blow equipment and 107 take out the classification taking-out section classified by intensity, and 111 for the classification-by-color equipment classified by intensity, and 110, equipment and 112 show the on-the-strength classification classified by path class, and 113 shows the assortment equipment according to intensity. Hereafter, the structure and operation are explained based on each drawing of drawing 2 - drawing 10 . Drawing 2 is the front view of the D-D cross section of drawing 1 , and is mechanism explanatory drawing of an injection of a log, carrying in, and a taking-out portion. drawing -- setting -- 9 -- the chain for ** material, and 12 -- the chain for carrying in, and 13 -- a ***** switch and 17 -- in a discharge cylinder and 18, a partition material ** material frame and 84 take out an injection frame and 83, a taking-out cylinder and 21 take out a log and 111 for a ** material motor and 100, and equipment and 102 show a feeder (carrying-in section)

[0007] <A To HREF="/Tokujitu/tjitemdrw.ipdl?N0000=237&N0500=1E_N/;>>?9; <? 9///&N0001=42&N0552=9&N0553=000004" TARGET="tjitemdrw"> drawing 2 With the injection equipment 8 of a log, it sets, and the log is beforehand loaded on the chain 9 for ** material of the injection frame 21, and an injection switch (not shown) is operated, the motor 10 for ** material is driven, and it puts one at a time on the carrying-in frame 14. If put on the aforementioned carrying-in frame 14, carrying-in frame drive [the 1st step of] cylinder 19 will rotate the carrying-in frame 14 to the position which becomes level to the surroundings of the carrying-in equipment axis of rotation 11, and will stop. And if the chain 12 for carrying in is driven by the ** material motor 84, it sends to the nose of cam of the carrying-in frame 14 and the ***** switch 13 turns on, while stopping the ** material motor 84, the carrying-in frame 14 is rotated in carrying-in frame drive [the 2nd step of] cylinder 20, and a log is carried on the wheel 3 (drawing 1 , drawing 3) for ** material.

[0008] Drawing 3 is the front view of the main part of grading equipment of the log of this invention, and is outline explanatory drawing. In drawing, in a coloring positioning stopper and 5, the limit switch for a coloring material check and 7 show a blow positioning stopper, and 85 shows [2 / the positioning stopper of diameter measurement, and 4] a ** material motor. In addition, the classification-by-color equipment 109 (drawing 1 , drawing 7 postscript) classified by intensity was omitted.

[0009] Next, the structure of the weight metering device 104 shown in drawing 3 and an operation are explained. Drawing 4 is the side elevation of the weight metering device 104. drawing -- setting -- 56 -- a log support plate and 57 -- a log support plate receptacle and 58 -- a load cell

receptacle implement, 59 load cells, and 60 -- in the 2nd step cylinder for weight measurement, and 61, the 2nd step dummy support, and 64 and 65 show 66, and, as for the 1st step cylinder for weight measurement, and 62, guide block and 67 show a guide rail, as for the 1st step dummy support and 63 In drawing 4 , after lifting a log in the 1st step cylinder 61 for weight measurement and stabilizing a log in the position put on the wheel 3 (drawing 1 , drawing 3) for ** material by the aforementioned carrying-in frame 14 (drawing 1 , drawing 2), with the log support plate 56 fixed to the load cell receptacle implement 58 through the load cell 59 in the 2nd step cylinder 60 for weight measurement, a log is lifted and a weight is measured with a metering device. As for a weight metering device, it is desirable to use the guide block 64 and 65 with which the ball bearing was enclosed so that the disturbance by frictional resistance etc. might not influence the display of a load cell, and guide rails 66 and 67. The above-mentioned weight measurement value is sent to the controller section 108 (drawing 1 , drawing 10), and serves as data of on-the-strength calculation. After the completion of weight measurement releases previously the 2nd step cylinder 60 for weight measurement, next releases the 1st step cylinder 61 for weight measurement, and it is made to protect a load cell 59. If the weight measurement backward above-mentioned load cell 59 is released, with the wheel 3 for ** material shown in drawing 3 , by the ** material motor 85, it will carry out ** material and will stop till the place of the positioning stopper 2 of diameter measurement.

[0010] Next, the structure of a path class metering device and an operation are explained. Drawing 5 is the B-B cross section of drawing 1 , and is the front view of a diameter metering device. drawing -- setting -- 46 -- the cylinder for diameter measurement, and 47 -- a guide rail and 48 -- guide block, and 49 and 51 -- the bar for the perpendicular direction diameter measurement, and 50 and 55 -- in guide block and 54, a guide rail, and 87, 88 and 90 show a bar, and 89 shows [the bar for horizontal diameter measurement, and 52 / a cylinder soffit positioning stopper and 53] the cylinder for diameter measurement As shown in drawing 5 , the length of the perpendicular direction of the cross section of wood of a log 100 is measured with the bars 49 and 51 for the perpendicular direction diameter measurement, and horizontal length is measured with the bars 50 and 55 for horizontal diameter measurement again, and both average is taken and it considers as the diameter of a log which is a cross section of wood on the other hand. It is fixed to guide block 48, and the bar 49 for the perpendicular direction diameter measurement enables it to slide on a guide-rail 47 top, and connects the guide block 48 with the end of the cylinder 46 for diameter measurement through a bar 86. The bar 51 for the perpendicular direction diameter measurement is connected also like the other end. The bars 50 and 55 for horizontal diameter measurement are also made into the same structure, and are connected with the cylinder 89 for diameter measurement. Since guide block which slides on a guide-rail top freely was connected so that it might consider as the end and the other end of a cylinder, it becomes unnecessary thus, to fix the position of a log 100 correctly at the time of measurement. That is, it is because it is hung by it and the whole cylinder can move, if a log is inserted with the aforementioned bar for diameter measurement.

[0011] Next, a log 100 is sent to the blow positioning stopper 7 through the wheel 3 for ** material (drawing 3), the diameter of the remaining cross section of wood of a log 100 is measured by the bars 32 and 33 for diameter measurement, and 34 and 35 like the above (drawing 6), and an average diameter is computed. The vertical and each level diameter measurement value of the above-mentioned cross section of wood are sent to the controller section (drawing 1 , drawing 10), and serve as data of on-the-strength calculation and a path class partition.

[0012] Next, the structure of the blow equipment of a log and an operation are explained. Drawing 6 is diameter measurement of a log, and explanatory drawing of blow equipment. In drawing a blow positioning stopper and 22 7 The cylinder for a blow, 23 a blow head and 25 for a blow equipment frame and 24 Guide block, In 26, a guide rail and 27 links 1 and 28 The cylinder for blow equipment movement, 29 the bearing for a link, and 31 for the guide rail for diameter measurement, and 30 Guide block, 32-35 guide block and 37 for the bar for diameter measurement, and 36 The bearing for a link, 38 the switch for *****, and 40 for links 2 and 39

Microphone maintenance metallic ornaments, 41 -- shock absorbing material and 42 -- the microphone for vibration pickups, and 43 -- a link pin and 44 -- in a hammer and 44', the coil-spring position at the time of a blow and 106 show blow equipment, and, as for the hammer position at the time of a blow, and 45, 107 shows a resonant frequency measuring device, as for a coil spring and 45'

[0013] As shown in drawing 6, blow equipment 106 is set in the state after the 2nd diameter measurement of a cross section of wood. As a hammer 44 is driven in the cylinder 22 for a blow after releasing the aforementioned bars 32 and 33 for diameter measurement, and 34 and 35, the cross section of wood of a log 100 is hit and it is shown in the resonant frequency measuring device 107. The resonance frequency of the sound at this time is collected with the microphone 42 for vibration pickups. in the controller section 108 (drawing 1, drawing 10) The frequency of the peak value of the wave is defined as the primary resonance frequency [secondary / 3rd] from the one where frequency is lower, and the 3rd resonance frequency (3rd resonance frequency) is adopted. Moreover, the aforementioned microphone 42 for vibration pickups is held with shock absorbing material 41, such as sponge, and is being fixed to the blow equipment frame 23. The cylinder 22 for a blow and the hammer 44 are attached in this blow equipment frame 23, and these whole is connected with it possible [sliding] by the link pin 43. Moreover, when the bars 34 and 35 for diameter measurement which slide on the guide-rail 29 top for diameter measurement through a link 1 (27) and a link 2 (38) opened and closed, this link pin 43 is interlocked with it, and the link pin 43 goes up and down it, and it enabled it to maintain the position of a hammer 44 at the center of a log 100. And the blow head 24 was formed at the nose of cam of the aforementioned cylinder 22 for a blow, the coil spring 45 was attached in the middle of the arm of a hammer 44, and the hammer 44 is drawn near from the opposite side of the blow direction. A position and strength are adjusted so that a coil spring 45 may not hit a log 100 further after a hammer's 44 hitting.

[0014] When abnormalities are in the judgment result of the above-mentioned measurement, and a measurement value, again, it hits and measurement is redone. When abnormalities are in a measurement result 5 times or more, measurement is stopped and a log and a system are checked.

[0015] Next, based on the "formula 1" shown in the following, the Young's modulus of a log is computed in the controller section 108 from the length of the log 100 beforehand inputted as the diameter of the log 100 read in the controller section 108 (drawing 1, drawing 10), the weight, and the resonant frequency (3rd resonance frequency). Then, a log 100 is sent to the coloring positioning stopper 4 with the wheel 3 (drawing 3) for ** material, and it is colored the cross section of wood of a log 100 according to intensity based on the on-the-strength grade which had carried out an arbitrary setup beforehand (postscript).

the above, and "formula 1": $Ef=4L^2f^2\rho/980$ -- here, they are the Young's modulus (Kgf/cm²) of Ef :log, and the density [of L:log] of a length (cm) f :log of a resonant frequency (Hz) ρ :log (kg/cm³)

[0016] Next, the coloring according to intensity to a log is explained. Drawing 7 is classification-by-color plant layout drawing classified by intensity with the C-C cross section of drawing 1. drawing -- setting -- 68 -- a coloring equipment drive cylinder and 69 -- a coloring equipment susceptor and 70 -- in spray fixed metallic ornaments and 73, a guide rail and 74 show guide block and 109 shows [a spray and 71 / the cylinder for coloring, and 72] the classification-by-color equipment classified by intensity ** [lighting of the coloring according to intensity to a log of the limit switch 5 (drawing 3) for a coloring material check / move / horizontally / to the center of a log 100 / the coloring equipment drive cylinder 68 / the coloring equipment susceptor 69 fixed through the guide block 74 which slides on the guide-rail 73 top of drawing 7] And the cylinder 71 for coloring is driven according to the directions from the controller section 108 (drawing 1, drawing 10), a spray 70 is pushed, and a log 100 is colored. For example, in a two or more Young's-modulus 70×10^3 Kgf/cm log, 50×10^3 Kgf/cm² \leq log $< 70 \times 10^3$ Kgf/cm² colors red blue and a less than two 50×10^3 Kgf/cm log black.

[0017] And finally a log 100 is sent to the coloring positioning stopper 4 with the wheel 3 (drawing 3) for ** material, and a log 100 is taken out out of a measuring instrument with the log

taking-out lever 15 (drawing 2). The above-mentioned log taking-out lever 15 is driven in the taking-out cylinder 18, and receives a log 100 with the log eccrisis lever 16. This log eccrisis lever 16 that received the log 100 is driven in the eccrisis cylinder 17, and takes down a log 100 to the partition material ** material frame 83.

[0018] Next, the classification after eccrisis is explained. Drawing 8 is drawing of the partition material eccrisis section and a partition material place with the A-A cross section of drawing 1 . In drawing, in a partition material ** frame and 76, a partition material eccrisis bearing and 77 show a partition material eccrisis lever (drawing 1), and 78 shows [75] a partition material eccrisis cylinder. After eccrisis, it takes out with the classification taking-out section 110 (drawing 10) classified by intensity of a log, equipment 111 (drawing 10) is controlled by the controller section 108 (drawing 1 , drawing 10), and it takes on-the-strength classification 112 (drawing 1 , drawing 10) according to the path class. The log 100 taken down on the partition material ** material frame 83 with the aforementioned log eccrisis lever 16 (drawing 2) aligns on the partition material ** frame 75 (drawing 1 , drawing 8) with the partition material eccrisis lever 77 (drawing 1 , drawing 8) according to the intensity classified by each grade by the koro 82 for ** material driven by the partition material ** material motor 79 (drawing 1).

[0019] Next, correlation of the actual bending Young's modulus of a timber trimming **** lumber article is indicated from it to be the Young's modulus of the log measured using this equipment. Drawing 9 is the correlation diagram of Young's modulus E_f of a log, and Young's modulus MOE of a lumber article. In drawing, they are R = correlation coefficient and n = measurement size. As shown in drawing, both correlation is understood that it is as high as 0.75 and the reliability of on-the-strength evaluation of this equipment is high.

[0020] The block diagram of the whole grading equipment of the log of this invention is shown in drawing 10 . In drawing, the controller section 108 is a computer, orders it on-the-strength calculation and control of equipment with the measurement data from the sensor of each aforementioned equipment, and carries out the on-the-strength partition of a log by classification by color with the classification-by-color equipment 109 classified by intensity. And after controlling the classification taking-out section 110 classified by intensity, and ejection equipment 111 after eccrisis and taking on-the-strength classification 112 classified by path class, a log 100 aligns on the partition material ** frame 75 according to the on-the-strength classification classified by path class according to the intensity classified according to the grade.

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DESCRIPTION OF DRAWINGS

[Brief Description of the Drawings]

[Drawing 1] The plan showing the whole grading equipment of the log of this invention, and the schematic diagram of the controller section.

[Drawing 2] With the front view of the D-D cross section of drawing 1, it is the organization chart of an injection of a log, carrying in, and a taking-out portion.

[Drawing 3] Front view of the main part of grading equipment of the log of this invention.

[Drawing 4] The side elevation of a weight metering device.

[Drawing 5] Front view which is a diameter metering device with the B-B cross section of drawing 1.

[Drawing 6] Diameter measurement of a log, and explanatory drawing of blow equipment.

[Drawing 7] It is classification-by-color plant layout drawing classified by intensity with the C-C cross section of drawing 1.

[Drawing 8] It is drawing of the partition material eccentric section and a partition material place with the A-A cross section of drawing 1.

[Drawing 9] The correlation diagram of Young's modulus E_f of a log, and Young's modulus MOE of a lumber article.

[Drawing 10] The block diagram of the whole grading equipment of the log of this invention.

[Description of Notations]

- 1: Diameter measurement section covering 2: Positioning stopper of diameter measurement
- 3: Wheel for ** material 4: Coloring positioning stopper
- 5: Limit switch for a coloring material check 6: Measurement section covering
- 7: Blow positioning stopper 8: Injection equipment
- 9: Chain for ** material 10: Motor for ** material
- 11: Carrying-in equipment axis of rotation 12: Chain for carrying in
- 13: ***** switch 14: Carrying-in frame
- 15: Log taking-out lever 16: Log eccentric lever
- 17: Eccentric cylinder 18: Taking-out cylinder
- 19: Carrying-in frame drive [the 1st step of] cylinder,
- 20: Carrying-in frame drive [the 2nd step of] cylinder,
- 21: Injection frame 22: Cylinder for a blow
- 23: Blow equipment frame 24: Blow head
- 25: Guide block 26: Guide rail
- 27: Link 1 28: Cylinder for blow equipment movement
- 29: Guide rail for diameter measurement 30: Bearing for a link 1
- 31: Guide block 32-35: Bar for diameter measurement
- 36: Guide block 37: Bearing for a link 2
- 38: Link 2 39: Switch for *****
- 40: Microphone maintenance metallic ornaments 41: Shock absorbing material
- 42: The microphone for vibration pickups,
- 43: Link pin 44: Hammer
- 44': Hammer position at the time of a blow 45: Coil spring
- 45': Coil-spring position at the time of a blow 46: Cylinder for diameter measurement

47: Guide rail 48: Guide block
 49 51: Bar for the perpendicular direction diameter measurement 50 55: Bar for horizontal diameter measurement
 52: A cylinder soffit positioning stopper, 53 : guide block
 54: Guide rail 56: Log support plate
 57: Log support plate receptacle 58: Load cell receptacle implement
 59: Load cell 60: The 2nd step cylinder for weight measurement
 61: The 1st step cylinder for weight measurement The 62:1st step dummy support
 The 63:2nd step dummy support 64 65: Guide block
 66 67: Guide rail 68: Coloring equipment drive cylinder
 69: Coloring equipment susceptor 70: Spray
 71: Cylinder for coloring 72: Spray fixed metallic ornaments
 73: Guide rail 74: Guide block
 75: Partition material ** frame 76: Partition material eccrisis bearing
 77: Partition material eccrisis lever 78: Partition material eccrisis cylinder
 79: Partition material ** material motor 80: Sprocket
 81: Chain for ** material 82: Koro for ** material
 83: Partition material ** material frame 84: ** material motor
 85: ** material motor 86, 87, 88, 90: Bar
 89: Cylinder for diameter measurement 100: Log
 101: Grading equipment 102: Feeder (carrying-in section)
 103: On-the-strength measurement section 104: Weight metering device
 105,105': Path class metering device 106: Blow equipment
 107: Resonant frequency measuring device 108: Controller section
 109: Classification-by-color equipment classified by intensity 110: The classification taking-out section classified by intensity
 111: Ejection equipment 112: On-the-strength classification classified by path class
 113: Assortment equipment according to intensity

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ABSTRACT:

PROBLEM TO BE SOLVED: To classify logs by strength, by measuring weights, diametrical classes, impacts and natural frequencies of the logs on the basis of signals from a controller part of a strength-sorting apparatus and calculating strengths of logs on the basis of the measured values.

SOLUTION: A log is raised and stabilized by a weight measurement first-stage cylinder at a position where the log is loaded on a log transfer wheel 3. The log is raised and a weight of the log is measured by a second-stage cylinder at a log-supporting plate fixed to a receiver instrument via a load cell. A length of a cut end of the log in a vertical direction is measured by a vertical direction diameter measurement bar, and a length in a horizontal direction is measured by a horizontal direction diameter measurement bar. The lengths are averaged, thereby obtaining a diameter. A striking apparatus 106 drives a hammer by a strike cylinder to hit the cut end of the

log. A natural frequency-measuring apparatus 107 measures a tertiary resonant frequency of the sound at this time. A Young's modulus is calculated from the diameter, weight read by a controller part 108, natural frequency and length. The log is sorted by color on the basis of a set strength class.

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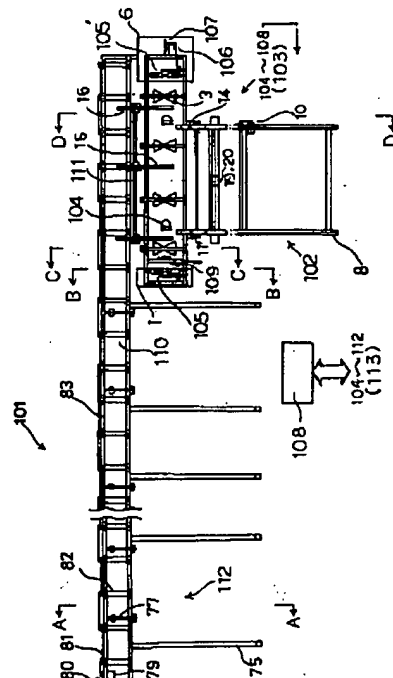
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(54) 【発明の名称】 丸太の等級区分装置

(57) 【要約】

【課題】従来の丸太の強度等級区分は、市場ではえ積み状態で木口をハンマー等で打撃して固有振動数を計測し、ヤング係数を推定する簡易方法で、個々の丸太の強度値としては信頼性が不足し、また手動のため多大な労力を要し仕分けの効率は悪かった。

【解決手段】強度別仕分け装置を、丸太の重量計測装置と、径級計測装置と、丸太の打撃装置及び固有振動数測定装置と、前記各装置の計測値に基づいて強度計算を行うコントローラ部とからなる丸太の強度計測部と、その信号により丸太を強度別に色分けして仕分ける装置と、径級別に仕分ける装置から構成し、測定値の信頼性と区分効率の向上を図る。



【特許請求の範囲】

【請求項1】丸太の供給装置102と強度別仕分け装置113を備えた丸太の等級区分装置101において、強度別仕分け装置113が、丸太の重量計測装置104と、径級計測装置105、105'と、丸太の打撃装置106及び固有振動数測定装置107と、前記各装置の計測値に基づいて強度計算を行うコントローラ部108とからなる丸太の強度計測部103とを備えてなり、前記コントローラ部108からの信号に基づいて丸太を強度別に仕分けするものであることを特徴とする丸太の等級区分装置。

【請求項2】丸太の強度別仕分け装置113が、丸太を強度別に色分けする強度別色分け装置109を備えてなることを特徴とする請求項1に記載の丸太の等級区分装置。

【請求項3】丸太の重量計測装置104が、2段階に設けてなる搬入フレーム駆動1段目シリンダ19、搬入フレーム駆動2段目シリンダ20を介してロードセル59にて重量を計測するものであることを特徴とする請求項1又は2に記載の丸太の等級区分装置。

【請求項4】丸太の打撃装置106が、打撃部のハンマー44を打撃方向の後方からコイルバネ45により引き寄せ、打撃用シリンダ22の先端に打撃ヘッド24を設けてなることを特徴とする請求項1～3のいずれか1項に記載の丸太の等級区分装置。

【請求項5】丸太の径級計測装置105、105'が、両端木口部の直径を直径計測用シリンダ46、89に支持した鉛直方向直径計測用バー49、51並びに水平方向直径計測用バー50、55により、上下、左右から計4箇所を計測し、平均直径を算定するものであることを特徴とする請求項1～4のいずれかの1項に記載の丸太の等級区分装置。

【請求項6】丸太の打撃装置106が、丸太の大きさに応じて打撃部のハンマー44の位置並びに打撃による振動ピックアップ用マイクロフォン42の位置が、丸太の中心にくるように作動する自動位置決め機構を設けてなることを特徴とする請求項1～5のいずれか1項に記載の丸太の等級区分装置。

【請求項7】丸太の打撃装置106が、マイクロフォンを保持する際に緩衝材41を用いてなることを特徴とする請求項1～6のいずれか1項に記載の丸太の等級区分装置。

【請求項8】丸太の等級区分装置101のコントローラ部108が、丸太を打撃したときの固有振動数を読み取り、第3次共振周波数を計測値として、丸太の強度計算を行うものであることを特徴とする請求項1～7のいずれか1項に記載の丸太の等級区分装置。

【請求項9】丸太の等級区分装置において、強度等級と径級等級とを同時に仕分けするようにしたことを特徴とする請求項1～8のいずれか1項に記載の丸太の等級区

分装置。

【発明の詳細な説明】

【0001】

【発明の属する技術分野】本発明は、丸太の供給装置と、強度別仕分け装置を備えた丸太の等級区分装置に関する。

【0002】

【従来の技術】丸太の強度等級を区分する装置としては、原木市場等におけるはえ積み状態で、丸太の木口をハンマー等で打撃し、その時の丸太の固有振動数を計測し、丸太のヤング係数を推定する簡易な方法が提案されている（特開平7-103945公報）。また、丸太の径級の区分は、原木市場等で丸太の直径を計測することで一般的に行われているが、これまでに丸太の強度区分（強度別仕分け）を機械的に行っている例はみられない。

【0003】

【発明が解決しようとする課題】従来の丸太の強度等級の区分技術においては、はえ積み状態のグループ単位で丸太の密度を推定し、その値を用いてヤング係数を算出することから、丸太のおおよその強度しかわからない。このため、はえ積み状態のグループ単位同志あるいは、そのグループ単位の中での丸太同志の強度の比較はできるが、算出した値を個々の丸太の強度値として評価するには信頼性が不足している。また、従来の方法では、測定を人手に頼っているため、全数測定するには多大な労力を要し、あわせてはえ積み状態で測定するため、丸太を強度等級ごとに仕分けするには、効率が劣っていた。

【0004】

【課題を解決するための手段】本発明者は、上記に鑑み鋭意研究の結果、原木市場等に集積された丸太について、個々の重量、径級及び固有振動数を機械的に全数測定し、信頼性の高い等級区分が可能な装置を提供し、さらに本装置を使用することによって、用途に応じた丸太の供給体制を確立し、木製品の製造の効率化を図ることを可能とした。すなわち本発明は下記構成の丸太の等級区分装置である。

(1) 丸太の供給装置102と強度別仕分け装置113を備えた丸太の等級区分装置101において、強度別仕分け装置113が、丸太の重量計測装置104と、径級計測装置105、105'と、丸太の打撃装置106及び固有振動数測定装置107と、前記各装置の計測値に基づいて強度計算を行うコントローラ部108とからなる丸太の強度計測部103とを備えてなり、前記コントローラ部108からの信号に基づいて丸太を強度別に仕分けするものであることを特徴とする丸太の等級区分装置。

(2) 丸太の強度別仕分け装置113が、丸太を強度別に色分けする強度別色分け装置109を備えてなることを特徴する(1)項に記載の丸太の等級区分装置。

(3) 丸太の重量計測装置104が、シリンダを2段階に設けてなる搬入フレーム駆動1段目シリンダ19、搬入フレーム駆動2段目シリンダ20を介してロードセル59にて重量を計測するものであることを特徴とする

(1) 項又は(2) 項に記載の丸太の等級区分装置。

(4) 丸太の打撃装置106が、打撃部のハンマー44を打撃方向の後方からコイルバネ45により引き寄せ、打撃用シリンダ22の先端に打撃ヘッド24を設けてなることを特徴とする(1) 項～(3) 項のいずれか1項に記載の丸太の等級区分装置。

【0005】(5) 丸太の径級計測装置105が、両端木口部の直径を直径計測用シリンダ46、89に支持した鉛直方向直径計測用バー49、51並びに水平方向直径計測用バー50、55により、上下、左右から計4箇所を計測し、平均直径を算定するものであることを特徴とする(1) 項～(4) 項のいずれか1項に記載の丸太の等級区分装置。

(6) 丸太の打撃装置106が、丸太の大きさに応じて打撃部のハンマー44の位置並びに、打撃による振動ピックアップ用マイクロフォン42の位置が、丸太の中心にくるように作動する自動位置決め機構を設けてなることを特徴とする(1) 項～(5) 項のいずれか1項に記載の丸太の等級区分装置。

(7) 丸太の打撃装置106が、マイクロフォンを保持する際に緩衝材41を用いてなることを特徴とする

(1) 項～(6) 項のいずれか1項に記載の丸太の等級区分装置。

(8) 丸太の等級区分装置101のコントローラ部108が、丸太を打撃したときの固有振動数を読み取り、第3次共振周波数を計測値として、丸太の強度計算を行うものであることを特徴とする(1) 項～(7) 項のいずれか1項に記載の丸太の等級区分装置。

(9) 丸太の等級区分装置において、強度等級と径級等級とを同時に仕分けするようにしたことを特徴とする

(1) 項～(8) 項のいずれか1項に記載の丸太の等級区分装置。

【0006】

【発明の実施の形態】発明の実施の形態を、事例に基づき図面を参照して説明する。図1は、本発明の丸太の等級区分装置の全体を示す平面図及びコントローラ部の系統図である。図において、1は直径計測部カバー、3は送材用車輪、6は計測部カバー、8は投入装置、10は送材用モータ、11は搬入装置回転軸、14は搬入フレーム、15は丸太搬出レバー、16は丸太排出レバー、19は搬入フレーム駆動1段目シリンダ、20は搬入フレーム駆動2段目シリンダ、75は区分材置フレーム、79は区分材送材モータ、80はスプロケット、81は送材用チェーン、82は送材用コロ、83は区分材送材フレーム、101は等級区分装置、102は供給装置(搬入部)、104は重量計測装置、105、105'

は径級計測装置、106は打撃装置、107は固有振動数測定装置、108はコントローラ部、109は強度別色分け装置、110は強度別仕分け搬出部、111は取り出し装置、112は径級別強度仕分け、113は強度別仕分け装置を示す。以下、図2～図10の各図に基づいてその構造と作用について説明する。図2は、図1のD-D断面の正面図で、丸太の投入、搬入、搬出部分の機構説明図である。図において、9は送材用チェーン、12は搬入用チェーン、13は材確認スイッチ、17は排出シリンダ、18は搬出シリンダ、21は投入フレーム、83は区分材送材フレーム、84は送材モータ、100は丸太、111は取り出し装置、102は供給装置(搬入部)を示す。

【0007】図2において、丸太の投入装置8により、予め投入フレーム21の送材用チェーン9の上に丸太を積載しておき、投入スイッチ(図示せず)を操作して送材用モータ10を駆動して搬入フレーム14へ1本ずつ載せる。前記搬入フレーム14へ載せられると、搬入フレーム駆動1段目シリンダ19が搬入フレーム14を搬入装置回転軸11の回りに水平になる位置まで回転させて止まる。そして、送材モータ84で搬入用チェーン12を駆動して搬入フレーム14の先端まで送り、材確認スイッチ13がONすると、送材モータ84を止めると共に、搬入フレーム駆動2段目シリンダ20で搬入フレーム14を回転させて丸太を送材用車輪3(図1、図3)の上に載せる。

【0008】図3は本発明の丸太の等級区分装置本体の正面図で、概要説明図である。図において、2は直径計測の位置決めストッパー、4は色づけ位置決めストッパー、5は色づけ材確認用リミットスイッチ、7は打撃位置決めストッパー、85は送材モータ、を示す。なお、強度別色分け装置109(図1、図7後記)は省略した。

【0009】次に図3中に示した重量計測装置104の構造と作用を説明する。図4は、重量計測装置104の側面図である。図において、56は丸太支持プレート、57は丸太支持プレート受け、58はロードセル受け具、59ロードセル、60は重量計測用2段目シリンダ、61は重量計測用1段目シリンダ、62は1段目支持金具、63は2段目支持金具、64、65はガイドブロック、66、67はガイドレールを示す。図4において、前記搬入フレーム14(図1、図2)によって送材用車輪3(図1、図3)に載せられた位置で、重量計測用1段目シリンダ61で丸太を持ち上げて丸太を安定させた後で、重量計測用2段目シリンダ60でロードセル59を介してロードセル受け具58に固定された丸太支持プレート56によって丸太を持ち上げ、計測装置で重量を計測する。重量計測装置は摩擦抵抗などによる外乱等がロードセルの表示に影響しないようにボールベアリングの封入されたガイドブロック64、65と、ガイド

レール66、67とを用いるのが好ましい。上記の重量計測値はコントローラ部108(図1、図10)に送られ、強度計算のデータとなる。重量計測完了後は、重量計測用2段目シリンダ60を先に解放し、次に重量計測用1段目シリンダ61を解放して、ロードセル59を保護するようにしている。重量計測後上記ロードセル59を解放したら、図3に示した送材用車輪3で直径計測の位置決めストッパー2のところまで送材モータ85で送材して止める。

【0010】次に径級計測装置の構造と作用を説明する。図5は図1のB-B断面図で、直径計測装置の正面図である。図において、46は直径計測用シリンダ、47はガイドレール、48はガイドブロック、49、51は鉛直方向直径計測用バー、50、55は水平方向直径計測用バー、52はシリンダ下端位置決めストッパー、53はガイドブロック、54はガイドレール、87、88、90はバー、89は直径計測用シリンダを示す。図5に示したように、丸太100の木口の鉛直方向の長さを、鉛直方向直径計測用バー49と51で計測した、水平方向の長さを、水平方向直径計測用バー50と55で計測して、両者の平均をとって丸太の一方木口の直径とする。鉛直方向直径計測用バー49はガイドブロック48に固定されてガイドレール47上を摺動できるようにし、そのガイドブロック48をバー86を介して直径計測用シリンダ46の一端に連結する。他端にも同じようにして鉛直方向直径計測用バー51を連結する。水平方向直径計測用バー50と55も同じ構造とし、直径計測用シリンダ89に連結する。このようにガイドレール上を自由に摺動するガイドブロックを、シリンダの一端と他端とするように連結したため、計測時に丸太100の位置を正確に固定する必要がなくなる。即ち、丸太を前記直径計測用バーで挟むと、それにつられて、シリンダ全体が移動できるからである。

【0011】次に、丸太100を送材用車輪3を介して打撃位置決めストッパー7まで送り(図3)、丸太100の残りの木口の直径を前記と同様に直径計測用バー32、33及び34、35で計測し(図6)、平均直径を算出する。上記木口の鉛直及び水平の各直径計測値は、コントローラ部(図1、図10)に送られ、強度計算及び径級区分のデータとなる。

【0012】次に丸太の打撃装置の構造と作用を説明する。図6は丸太の直径計測と打撃装置の説明図である。図において、7は打撃位置決めストッパー、22は打撃用シリンダ、23は打撃装置フレーム、24は打撃ヘッド、25はガイドブロック、26はガイドレール、27はリンク1、28は打撃装置移動用シリンダ、29は直径計測用ガイドレール、30はリンク用軸受け、31はガイドブロック、32～35は直径計測用バー、36はガイドブロック、37はリンク用軸受け、38はリンク2、39は材確認用スイッチ、40はマイクロフォン保

持金具、41は緩衝材、42は振動ピックアップ用マイクロフォン、43はリンクピン、44はハンマー、44'は打撃時のハンマー位置、45はコイルバネ、45'は打撃時のコイルバネ位置、106は打撃装置、107は固有振動数測定装置を示す。

【0013】図6に示したように、打撃装置106は、2回目の木口の直径計測後その状態において、前記直径計測用バー32、33・34、35を解放してから打撃用シリンダ22でハンマー44を駆動して、丸太100の木口を打撃し、固有振動数測定装置107に示すように、この時の音の共振周波数を振動ピックアップ用マイクロフォン42で集音し、コントローラ部108(図1、図10)で、その波形のピーク値の周波数を周波数の低い方から、1次、2次、3次共振周波数と定義し、3次の共振周波数(第3次共振周波数)を採用する。また、前記振動ピックアップ用マイクロフォン42はスポンジなどの緩衝材41で保持され、打撃装置フレーム23に固定されている。この打撃装置フレーム23には打撃用シリンダ22及びハンマー44が取り付けられており、それら全体がリンクピン43で摺動可能に連結されている。また、このリンクピン43は、リンク1(27)とリンク2(38)を介して直径計測用ガイドレール29上を摺動する直径計測用バー34、35が開閉すると、それに連動してリンクピン43が上下して、ハンマー44の位置を丸太100の中心に保つことができるようにした。そして前記打撃用シリンダ22の先端には打撃ヘッド24を設け、ハンマー44の腕の途中にコイルバネ45を取り付けて、打撃方向の反対側からハンマー44を引き寄せている。コイルバネ45はハンマー44が打撃後さらに丸太100を打撃しないように位置と強さが調節されている。

【0014】上記計測の判定結果、計測値に異常があった場合には、再度、打撃して計測をやり直す。5回以上計測結果に異常があった場合には、計測を中止して丸太及びシステムを点検する。

【0015】次に、コントローラ部108(図1、図10)で読み取った丸太100の直径、重量、及び固有振動数(第3次共振周波数)と予め入力されていた丸太100の長さから、下記に示す「数式1」に基づいてコントローラ部108において丸太のヤング係数を算出する。その後、丸太100を送材用車輪3(図3)で色づけ位置決めストッパー4まで送り、予め任意設定していた強度等級に基づいて、丸太100の木口に強度別に着色(後記)する。

前記、「数式1」： $E f = 4 L^2 f^2 \rho / 980$

ここで、 $E f$ ：丸太のヤング係数($K g f / c m^2$)、 L ：丸太の長さ($c m$) f ：丸太の固有振動数($H z$)、 ρ ：丸太の密度($K g / c m^3$)である。

【0016】次に丸太への強度別着色法を説明する。図7は図1のC-C断面図で強度別色分け装置図である。

図において68は色づけ装置駆動シリンダ、69は色づけ装置支持台、70はスプレー、71は色づけ用シリンダ、72はスプレー固定金具、73はガイドレール、74はガイドブロック、109は強度別色分け装置を示す。丸太への強度別着色法は、色づけ材確認用リミットスイッチ5(図3)が点灯すると、図7のガイドレール73上を摺動するガイドブロック74を介して固定された色づけ装置支持台69を、色づけ装置駆動シリンダ68が丸太100の中心まで水平方向に移動する。そして、コントローラ部108(図1、図10)からの指示に従って色づけ用シリンダ71を駆動してスプレー70を押し、丸太100に着色する。例えば、ヤング係数 $70 \times 10^3 \text{ Kg f/cm}^2$ 以上の丸太は赤色に、 $50 \times 10^3 \text{ Kg f/cm}^2 \leq \text{丸太} < 70 \times 10^3 \text{ Kg f/cm}^2$ は青色、 $50 \times 10^3 \text{ Kg f/cm}^2$ 未満の丸太は黒色に着色する。

【0017】そして、最後に送材用車輪3(図3)で丸太100を色づけ位置決めストッパー4まで送り、丸太搬出レバー15(図2)で丸太100を計測器外に搬出する。上記丸太搬出レバー15は搬出シリンダ18で駆動され、丸太100を丸太排出レバー16で受ける。丸太100を受け取ったこの丸太排出レバー16は排出シリンダ17で駆動して丸太100を区分材送材フレーム83まで降ろす。

【0018】次に排出後の仕分けを説明する。図8は図1のA-A断面図で区分材排出部及び区分材置き場の図である。図において75は区分材置フレーム、76は区分材排出軸受け、77は区分材排出レバー(図1)、78は区分材排出シリンダを示す。排出後、丸太の強度別仕分け搬出部110(図10)と取り出し装置111(図10)をコントローラ部108(図1、図10)で制御して、径級別に強度仕分け112(図1、図10)する。前記丸太排出レバー16(図2)で区分材送材フレーム83上に降ろされた丸太100は、区分材送材モータ79(図1)で駆動される送材用コ口82でそれぞれの等級に仕分けされた強度に従って、区分材排出レバー77(図1、図8)で区分材置フレーム75(図1、図8)上に整列される。

【0019】次に本装置を使用して測定した丸太のヤング係数と、それから木取った製材品の実際の曲げヤング係数の相関を示す。図9は丸太のヤング係数 E_f と、製材品のヤング係数 MOE との相関図である。図において、 R =相関係数、 n =サンプル数である。図に示したように、両者の相関関係は0.75と高く、本装置の強度評価の信頼性が高いことが判る。

【0020】図10に本発明の丸太の等級区分装置全体のブロック図を示す。図において、コントローラ部108はコンピュータで、前記各装置のセンサーからの計測データによって、強度計算及び装置の制御を指令し、また、強度別色分け装置109で丸太の強度区分を色分け

によって実施する。そして排出後、強度別仕分け搬出部110及び取り出し装置111を制御し、径級別強度仕分け112した後、丸太100は等級別に仕分けされた強度に従ってあるいは、径級別強度仕分けに従って区分材置フレーム75に整列される。

【0021】

【発明の効果】本発明によれば下記のごとき作用効果が発揮される。

1、請求項1の発明によれば、丸太の強度計測部は、重量計測装置と、径級計測装置と、打撃装置及びその固有振動測定装置により構成されており、これらの測定データをコントローラ部で総合的に計算し強度評価を行うため、実際の製材品の強度との相関が高く信頼性が高い。

2、請求項2の発明によれば、丸太の強度に応じて色分け装置で着色区分できるため、強度別の仕分け表示が鮮明で分かりやすい。

3、請求項3の発明によれば、測定に供する殆どの丸太は、曲がりやその断面が不整円であるので、重量計測装置の支持台に載せたとき、丸太は安定する方向に回転し衝撃的な荷重が重量計測装置にかかるが、本装置では丸太のシリンダを2段階とし、第1段目のシリンダで丸太を持ち上げて丸太を安定した位置で支持し、次にロードセルを介して第2段目のシリンダでさらに持ち上げる構造としたため、ロードセルに衝撃的な荷重が加わることを回避でき、正確な重量測定ができる。

4、請求項4の発明によれば、丸太の打撃部のハンマーを打撃方向の後方からバネによって引き寄せ、位置と強さが調整されているため、ハンマーが打撃後さらに丸太を打撃することが防止された、シリンダロッド先端には打撃ヘッドを取り付けたため、不要な打撃音の発生が押さえられる。

5、請求項5の発明によれば、丸太の両木口部において、直交する2方向から計測バーを当てて計測し、それらの平均値を直径値としたため、丸太の材積を求める際、断面の変形等による誤差を少なくすることができる。

6、請求項6の発明によれば、打撃装置が、打撃による振動ピックアップ用マイクロフォン及びハンマーの位置を、丸太の大きさに応じてその木口の中心にくるように自動位置決め機構を設けたため、正確な丸太の固有振動数の計測データを得ることができる。

7、請求項7の発明によれば、打撃音集音用マイクロフォンを、緩衝材を介して支持したことにより、支持体の振動により打撃音にノイズが混入することを防止できる。

8、請求項8の発明によれば、丸太を打撃したときの固有振動数を読み取り、第3次共振周波数を計測値としたため、丸太のヤング係数と、それから木取った製材品のヤング係数との相関性が高い。

9、請求項9の発明によれば、丸太の等級区分を、強度別等級と径級別等級とを同時に仕分けすることができるため、用途に応じた丸太の供給体制が確立でき、木材製品の製造の効率化を図ることができる。

【図面の簡単な説明】

【図1】本発明の丸太の等級区分装置の全体を示す平面図及びコントローラ部の系統図。

【図2】図1のD-D断面の正面図で、丸太の投入、搬入、搬出部分の機構図。

【図3】本発明の丸太の等級区分装置本体の正面図。

【図4】重量計測装置の側面図。

【図5】図1のB-B断面図で、直径計測装置の正面図。

【図6】丸太の直径計測と打撃装置の説明図。

【図7】図1のC-C断面図で強度別色分け装置図。

【図8】図1のA-A断面図で区分材排出部及び区分材置き場の図。

【図9】丸太のヤング係数E_fと、製材品のヤング係数MOEとの相関図。

【図10】本発明の丸太の等級区分装置全体のブロック図。

【符号の説明】

1：直径計測部カバー、
2：直径計測の位置決めストッパー
3：送材用車輪、
4：色づけ位置決めストッパー
5：色づけ材確認用リミットスイッチ、
6：計測部カバー
7：打撃位置決めストッパー、
8：投入装置
9：送材用チェーン、
10：送材用モータ
11：搬入装置回転軸、
12：搬入用チェーン
13：材確認スイッチ、
14：搬入フレーム
15：丸太搬出レバー、
16：丸太排出レバー
17：排出シリンダ、
18：搬出シリンダ
19：搬入フレーム駆動1段目シリンダ、
20：搬入フレーム駆動2段目シリンダ、
21：投入フレーム、
22：打撃用シリンダ
23：打撃装置フレーム、
24：打撃ヘッド
25：ガイドブロック、
26：ガイドレール
27：リンク1、
28：打撃装置移動用シリンダ
29：直径計測用ガイドレール、
30：リンク

1用軸受け
31：ガイドブロック、
32～35：直径計測用バー
36：ガイドブロック、
37：リンク
2用軸受け
38：リンク2、
39：材確認用スイッチ
40：マイクロフォン保持金具、
41：緩衝材
42：振動ピックアップ用マイクロフォン、
43：リンクピン、
44：ハンマー
44'：打撃時のハンマー位置、
45：コイルバネ
45'：打撃時のコイルバネ位置、
46：直径計測用シリンダ
47：ガイドレール、
48：ガイドブロック
49、51：鉛直方向直径計測用バー、
50、55：水平方向直径計測用バー
52：シリンダ下端位置決めストッパー、
53：ガイドブロック
54：ガイドレール、
56：丸太支持プレート
57：丸太支持プレート受け、
58：ロードセル受け具
59：ロードセル、
60：重量計測用2段目シリンダ
61：重量計測用1段目シリンダ、
62：1段目支持金具
63：2段目支持金具、
64、65：ガイドブロック
66、67：ガイドレール、
68：色づけ装置駆動シリンダ
69：色づけ装置支持台、
70：スプレッド
71：色づけ用シリンダ、
72：スプレッド固定金具
73：ガイドレール、
74：ガイドブロック
75：区分材置フレーム、
76：区分材排出軸受け
77：区分材排出レバー、
78：区分材排出シリンダ
79：区分材送材モータ、
80：スプロケット
81：送材用チェーン、
82：送材用コロ
83：区分材送材フレーム、
84：送材モータ
85：送材モータ、
86、87、

11

12

88、90:バー

89:直径計測用シリンダ、

101:等級区分装置、
装置(搬入部)103:強度計測部、
計測装置105、105':径級計測装置、
装置

100:丸太

102:供給

104:重量

106:打撃

107:固有振動数測定装置、
トロローラ部109:強度別色分け装置、
別仕分け搬出部111:取り出し装置、
別強度仕分け

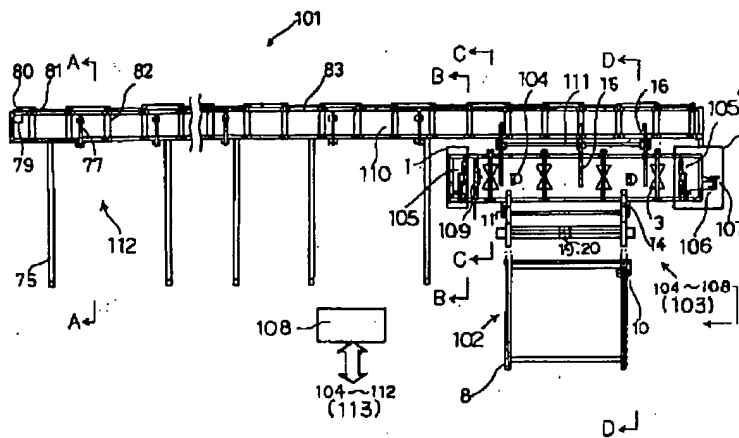
113:強度別仕分け装置

108:コン

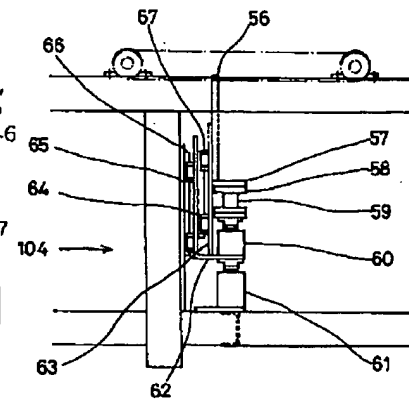
110:強度

112:径級

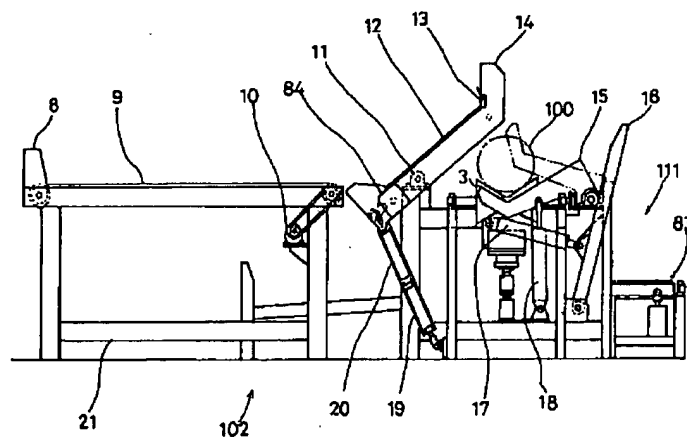
【図1】



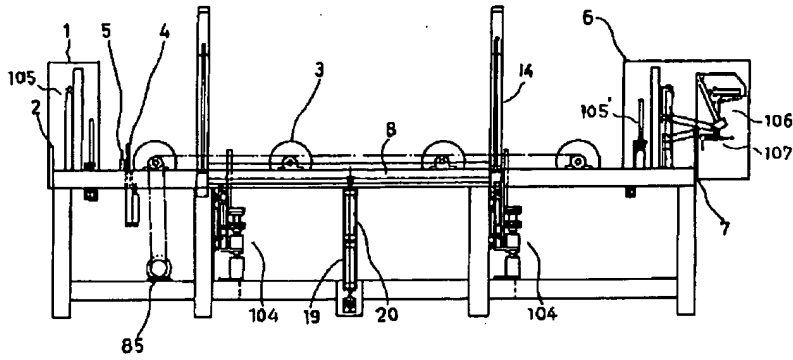
【図4】



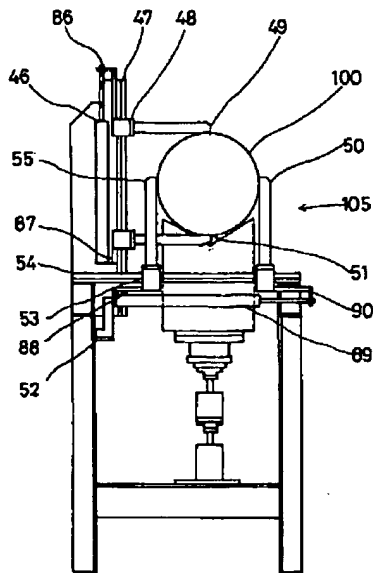
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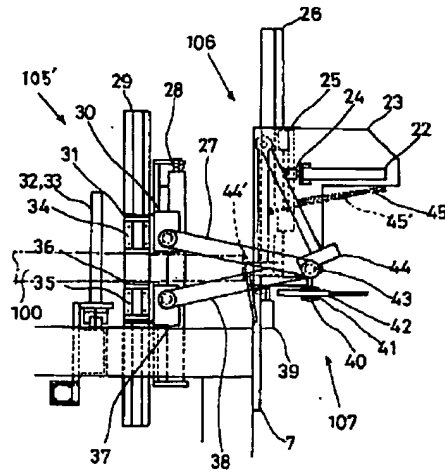
【図3】



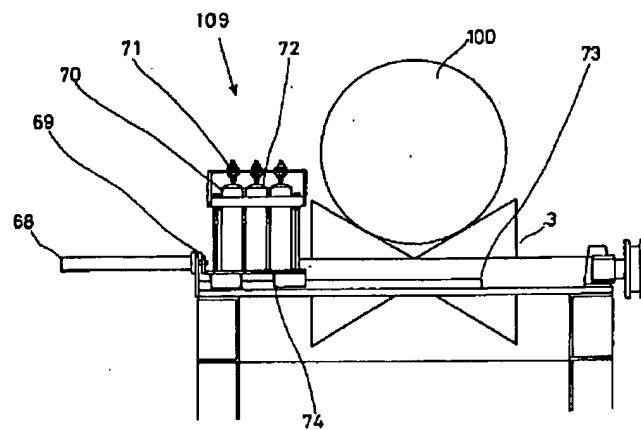
【図5】



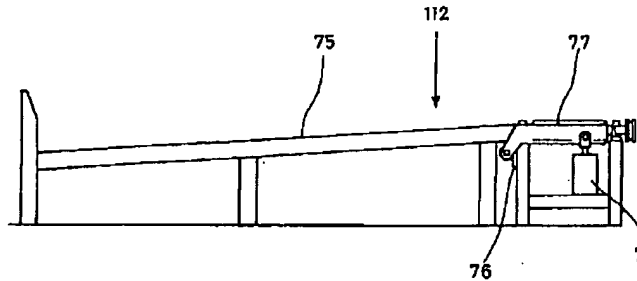
【図6】



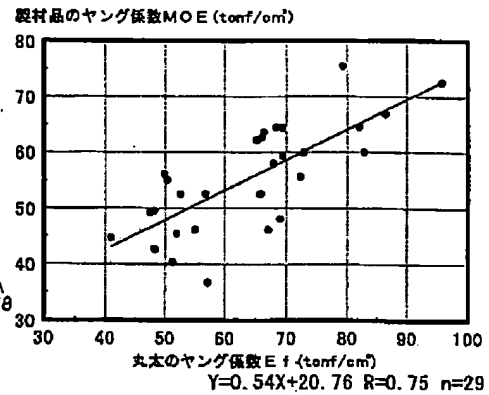
【図7】



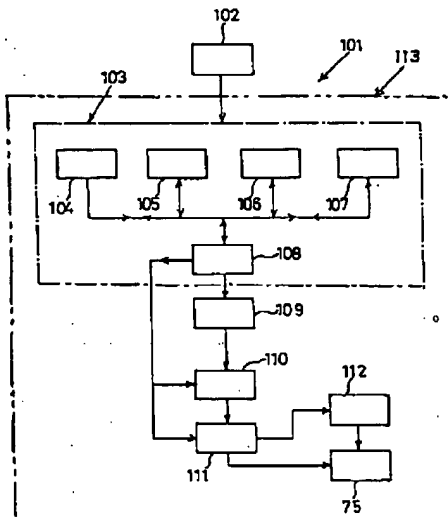
【図8】



【図9】



【図10】



- 101: 等級区分装置 102: 供給装置 (搬入部)
 103: 強度計測部 104: 重量計測装置
 105: 径計測装置 106: 打撃装置
 107: 固有振動数測定装置 108: コントローラ部
 109: 強度別色分け装置 110: 強度別仕分け搬出部
 111: 取り出し装置 112: 径別強度仕分け
 113: 強度別仕分け装置 75: 区分装置フレーム

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